NRCS	**Michigan Technical Note** **USDA-Natural Resources Conservation Service**

AGRONOMY 44

Common Terms Used in Irrigation Water Management Training

Average Application Rate (AAR) (in/hr) The rate of water application over a wetted area.

Center Pivot Evaluation Design (**CPED)** Computer software program from the University of Nebraska used to calculate irrigation water application uniformity.

CP Nozzle Computer software program from the University of Nebraska used to calculate potential runoff from over applying irrigation water.

Dammer-Diker Row cultivating equipment used to reduce erosion after planting by creating small earth dam reservoirs in the row middles between deep furrows or ridges to prevent water runoff in "bigfoot" like prints.

Depth of Application Depends on the amount of water that can be stored in the soil root zone and the irrigation application efficiency.

Drop Tubes Plastic, rubber hose, or metal tubes used to deliver water to a spray nozzle mounted below the pivot pipeline.

Evapotranspiration (ET) Coefficients for Irrigated Crops Simply the total water loss to the atmosphere. ET is determined by using the Average Daily Et values for alfalfa, corn, soybeans, dry edible beans and potatoes in nine Michigan districts or from local weather data.

Impact Sprinkler Water application device equipped with one or two nozzles and an impact arm (hammer) to cause sprinkler rotation and water stream breakup.

Instantaneous Application Rate (IAR) The peak intensity of water application at a single point in the field. Many systems, today, are low pressure and nozzle technology can apply large volumes of water over a small area, thus IAR may exceed MAR. However, Low pressure systems were designed to reduce droplet size and fall height and irrigation induced splash erosion. IAR can be determined using irrigation scheduling catch cans or the CP nozzle program from the University of Nebraska. Reducing the GPM from the water source can reduce runoff at the same application depth. Application rate can be changed by adjusting the speed the sprinkler system travels or changing the type of sprinkler devise or increasing the operating pressure of the irrigation system to increase the wetted diameter.

Irrigation Requirement (IR) The quantity of water, exclusive of precipitation, to be supplied by artificial means. IR is dependent on ET, water application efficiency, precipitation, and water supplied by percolation or capillary movement for groundwater.

Irrigation Scheduling Water budget used to determine when irrigation and how much water should be applied to satisfy crop need based on rooting depth. *The feel and appearance method is widely used in Michigan to measure soil moisture. See the NRCS pamphlet: Estimating Soil Moisture by Feel and Appearance. 2005. USDA NRCS Program Aid Number 1619.*

Irrigation System Design Influenced by: Infiltration rate, moisture holding capacity of the soil, rooting depth, and moisture use rate (ET by crop) and length of the crop growing season. The MSUE MI irrigation scheduler program has information for specific soil types and the various crops irrigated in Michigan.

Irrigation Period Time required covering a field with one application of water often expressed in days. Ex: 3 days.

Low Energy Precision Application or **LEPA (Halfway)** Sprinkler systems are designed so water does not immediately soak into soil. Proper design often calls for tillage practices that hold the water on the soil surface where it lands until it has time to infiltrate into the soil. LEPA is a system that includes: mounting LEPA heads less than 2 feet (12-18 inches) above the soil surface, planting the crop in a circle, creating and maintaining storage basins (Bigfoot prints) to store irrigation water. LEPA systems are designed not to exceed the surface storage volume. If operated as a lateral move machine then rows are straight rows. Devices for irrigating usually run in alternate rows.

Low Elevation Spray Application or **LESA** and **Mid-Elevation Spray Application MESA.** These describe similar irrigation application systems that embody the LEPA technology but do not meet one or more of the criteria to be called LEPA. These systems are designed to operate either as a center-pivot or lateral-move machine. Typically LESA systems are one to two feet above the ground while MESA systems can vary from five to ten feet above the ground. C

Low Pressure in Canopy or **LPIC** systems may or may not include a complete water, soil and plant management regime as required in LEPA. Application devices are located in the crop canopy with drop tubes mounted on low-pressure center pivot and linear move sprinkler irrigation systems. LPIC is a hybrid of LESA and MESA. Growers may adjust the nozzles to spray up into the leaves.

Maximum Application Rate (MAR) (In/hr) Infiltration rate of the soil that has been wetted for several hours.* MAR is based on soil infiltration rates (inches/hr) with an adjustment for residue present on the field surface. W*here plants are small or for bare soil reduce irrigation rates to about one-half. * See Table 1 in the NRCS MI 449 Job Sheet Irrigation Water Management to Protect Ag Resources.*

Maximum Application Rate (in/hr) Determined by inventory and evaluation of predominate or critical soil slope and soil intake family. Soil Intake Families are available from the: *MI eFOTG, Section II/ Natural Resources Information/ Soils Information/ Soils Information County Level/ County/ Irrgrps.doc*. MAR is then determined by using Table 1 in the NRCS MI 449 Irrigation Water Management job sheet based on soil intake family and slope. MAR decreases with increased slope to prevent runoff and encourage infiltration. The amount of crop residue left on the soil surface after planting can increase infiltration, reduce irrigation water splash erosion, and reduce irrigation sheet and rill erosion. MAR can be increased by multiplying by the **Irrigation Rate Adjustment Factor (IRAF)** based on the percent and type

of residue left on the soil surface at planting. See the NRCS MI 449 job sheet and RUSLE 2 Crop management file used for erosion prediction to determine the IRAF based on the amount of residue left

Mean droplet size Weighted average size of water droplet produced by a sprinkler nozzle at a specific operating pressure

Moisture Holding Capacity (inches/ ft) The field capacity less the wilting point. Moisture above the field capacity drains away too quickly for plants to make use of it and moisture below the wilting point can't be taken up by the plants.

Nozzle An opening in a sprinkler or spray nozzle used to control water flow rate out to a specific field area.

PUMP sized by Gallons per Minute (GPM) A pump is required to lift the water from the source, push it thorough the distribution system and spray it over the area. Pump types vary with the rate of flow, the discharge pressure, and the vertical distance to the water source. Pumps should have adequate capacity for future and present needs. Capacity generally varies for 100-800 GPM for most small irrigation installation. Pumps powered by Three-phase electricity are often cheaper to operate and maintain than a pump powered by diesel fuel. However, Three-phase power must be available or added with a power conversion unit to reduce operating cost.

Oscillating pad A spray nozzle with a deflection pad that oscillates when impacted by the water stream leaving the nozzle.

Rotating pad A spray nozzle with a deflection pad that oscillates when impacted by the water stream leaving the nozzle or a spray nozzle with a deflection pad that rotates in a 360 degree circle when impacted by the water stream leaving the nozzle.

Root Depth The depth above which most roots occur, unless restricted by hardpan or other such layers. Determine rooting depth based on crop type and growth stage or field observation.

Seasonal Water Use: (acre inches per month) the amount of water used to grow field crops in one season.

Self propelled (center-mounted) lateral (Center Pivot)

1. Radial line rotates slowly around a central pivot by water pressure or electric motors.
2. Towers are supported by wheels or skids and are kept aligned with supporting waters.
3. Nozzles increase in size from the pivot to the end of the line (Hence the term Nozzle package) A large sprinkler is placed at the end of the line to obtain the maximum diameter of coverage.
4. Nozzles are selected to provide a uniform depth of application varying from ½ to 4 inch per revolution.
5. Depth of application is determined by speed of the rotation.
6. Best suited for sandy soils, but can be set up for heavier soils if depth of application is reduced significantly (See Irrigation Soil Intake Family).
7. A quarter section center pivot design is 1285 feet in length and irrigates about 135 acres. The remaining 25 acres in the corners are not covered unless extension arms are added.

8. Wheels can be turned parallel to the pipe on some self propelled laterals and moved from field to field.
9. Wheels on towers are hydraulic or electric driven.

Soil Intake Rate: (in/hr) The rate at which a soil can absorb or take in water. Soil series in the same soil intake family have the same soil intake rate.

Spray pad Water distribution device equipped with a stationary, rotating or oscillating deflection pad used to distribute water in 180 to 360 degree circles

Sprinkler Package A group of sprinkler/nozzles installed on a center pivot to irrigate a specific field area.

Stationary pad Spray nozzle with a deflection pad that does not move when impacted by the water stream leaving the nozzle.

Total Moisture Holding Capacity The sum of moisture available to the plant for each soil horizon profile taken to the depth of irrigation, which is usually the rooting depth.

Wetted Diameter The diameter of water produced by a spray nozzle operating as a specified height, pressure and nozzle type. Wetted Diameter: is determined by the type of sprinkler device and operating pressure of the irrigation system. A maximum wetted diameter should be selected to produce little or no runoff after planting. In no case should water be applied faster than it will move into the soil under the cropping conditions encountered. If this rule is followed, runoff and erosion from irrigation will not occur.

Water Application Efficiency The water stored in the root zone or the fraction of water pumped that reaches the crop root zone. For sprinklers the water application efficiency is assumed to be about 70% i.e. 70% of each acre inch of water is available to the plants, the rest is lost by ET and other distribution losses. (Pipe leaks, friction, etc.). Nebraska rates various water application efficiencies as follows by type of sprinkler delivery nozzles:

Irrigation System Type	*Water Application Efficiency*
High Pressure Impact Systems	80%
Low Pressure Impact Systems*	85%
Spray Nozzles mounted on Drop Tubes	85-90%

*spray nozzles mounted on top of the pipeline

Water Use Efficiency The percentage of output water beneficially used including leaching water.

Water Input The amount of water delivered.

References

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